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tourtuousity, predilation, stent type / size / length and heart rate did not influence the degree of the positioning error statistically.
Conclusions: Stent positioning with IVUS marking technique provides accurate stent deployment in various settting for minimizing longitudinal geographic miss.

TCT-352

Defining the True Threshold Of Measurement Error in the Volumetric Virtual Histology Analysis of High Risk Plaques: Important Implications for the Serial Study of Plaque Composition

Scott W Murray[1], Rodney H Stables[1], George Hart[2], Nick D Palmer[1]
[1]Liverpool Heart and Chest Hospital, Liverpool, United Kingdom[2]University of Liverpool, Liverpool, United Kingdom

Background: Previous studies examining the validity and variability of Intravascular Ultrasound based Virtual Histology (IVUS-VH) have been confined to stable patients with mild or moderate disease. However, in serial clinical studies, accurate volumetric analysis is required involving segments with a high plaque burden. No data currently exists on the exact level of predicted measurement error (in mm^3) for the technique in this setting. We sought to determine the true value of measurement error for volumetric plaque characterisation in high risk, acute coronary syndrome (ACS) patients.
Methods: We performed IVUS-VH analysis along defined proximal coronary segments involving an ACS culprit lesion prior to PCI using motorised (0.5mm/sec) pullbacks. The data was analysed off-line at intervals of two weeks by two independent, experienced operators, to compare for intra (n=17 x 2) and inter-observer (n=17) variability. Automated, followed by manual, lumen and vessel contour detection was performed by each operator prior to computer-based calculation of plaque constituent volumes, which were compared using intra class correlation coefficient (ICC). Within-subjects standard deviations (WSSD) (mm^3) were also determined, allowing calculation of the repeatability co-efficient (RCO=$1.96 \times \Sigma\Theta\Pi(2\ \xi$ within subject SD in mm^3). This determined the exact error level that 95% of future measurements will not exceed.
Results: All intra-observer measurements had ICC>0.99 confirming excellent agreement on repeat analysis by a single individual. More interestingly, the results for inter-observer differences are as follows: Segment Length - ICC=0.95, WSSD=1.8mm, RCO=3.7mm; Total Plaque Volume - ICC=0.99, WSSD=5.9mm^3, RCO=6.73mm^3; Fibrous Volume - ICC=0.99, WSSD=3.3mm^3, RCO=5mm^3; Fibrofatty Volume - ICC=0.94, WSSD=2mm^3, RCO=3.92mm^3; Necrotic Core - ICC=0.98, WSSD=2.57mm^3, RCO=4.4mm^3; Dense Calcium - ICC=0.90, WSSD=3.1 mm^3, RCO=4.88 mm^3
Conclusion: This in-depth measurement study is the first to determine the true threshold of error for repeat measurements in ACS patients with a large, unstable plaque burden. Although the intra and inter-observer ICC suggests excellent agreement (>0.9 - as in previous studies), it must be noted that this may still result in a measurement error between 4 and 5mm^3 for individual plaque components. Future studies utilising volumetric plaque analysis with IVUS-VH in ACS should ensure that plaque endpoints do not encroach upon these figures, as it may invalidate their results.

TCT-353

A Novel Approach for the Co-registration of Coronary Angiographic and Intravascular Ultrasound Images: A Validation Study

Shengxian Tu[1], Niels R. Holm[2], Zheng Huang[3], Gerhard Koning[1], Kai Cui[3], Yuqing Hou[3], Johan H. C. Reiber[1]
[1]Leiden University Medical Center, Leiden, Netherlands[2]Aarhus University Hospital, Skejby, Denmark[3]Nanfang Hospital Affiliated to Southern Medical University, Guangzhou, China

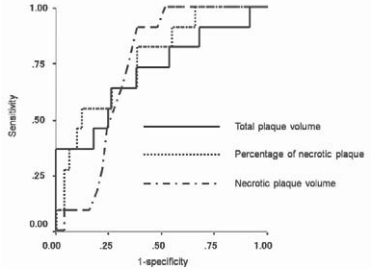
Background: The co-registration of coronary X-ray angiographic (XA) and intravascular ultrasound (IVUS) images is extremely important for combining information from the two imaging modalities for the assessment of the extent of coronary artery disease and for the online support of coronary interventions. This study presents the first phantom and in-vivo validation results for a new XA-IVUS registration approach (Medis medical imaging systems bv, Leiden, The Netherlands).
Methods and Materials: The vessel of interest was reconstructed from segmented coronary segments from two angiographic views (either biplane or 2 monoplane views) and registered with the corresponding IVUS pullback series by a distance mapping algorithm. The algorithm estimated the axial position of each IVUS cross-sectional image from the reconstructed vessel centerline based on the curvature and hence, to skip the reconstruction of the pullback trajectory, which is a necessary and non-trivial step in conventional registration approaches. The accuracy of the registration was retrospectively evaluated on 6 different silicone phantoms with coronary stents placed by the culotte two-stent technique, and on 24 patients who underwent both coronary angiography and IVUS examinations of the left anterior descending artery. Stent borders or sidebranches were used as markers for the validation. While the most proximal marker was set as the reference point for the distance mapping, the subsequent markers were used to evaluate the registration error. The correlation between the registration error and the distance from the evaluated marker to the reference point was analyzed.
Results: The registration error for the phantom validation was 0.08 ± 0.27 mm. For the in-vivo validation, 2 patients were excluded from the study due to insufficient image quality for the analysis. In total 78 sidebranches were identified from the remained 22 patients and the registration error was evaluated on 56 markers. The registration error is 0.03 ± 0.45 mm ($p = 0.67$). The error was not correlated to the distance between the evaluated marker and the reference point ($p = 0.73$).
Conclusion: The new XA-IVUS registration approach is a straightforward and reliable solution for the integration of X-ray angiographic and IVUS imaging. It provides the interventionalist with detailed information about vessel size and plaque size at every position along the vessel of interest, making this a suitable tool during the actual intervention.

TCT-354

Tissue Characterizations Using Newly Developed 40 MHz Intravascular Ultrasound Imaging System Can Predict Slow Flow Phenomenon During Coronary Intervention

Makoto Utsunomiya, Masato Nakamura
Toho University Ohashi Medical Center, Tokyo, Japan

Objectives: To evaluate the plaque characteristics that predispose to the slow flow phenomenon during percutaneous coronary intervention (PCI).
Background: The slow flow phenomenon is a serious complication of PCI and is associated with a worse prognosis. It is difficult to predict this phenomenon from grey-scale intravascular ultrasound (IVUS) data obtained before PCI. "iMap™" is new software for assessing plaque composition from data obtained by 40 MHz IVUS imaging.
Methods: Ninety-five consecutive patients underwent 40 MHz IVUS, including 33 with acute coronary syndrome and 62 with stable lesions. Plaque volume was calculated by IVUS and plaque components were detected by iMap software. Then plaques were characterized as fibrotic, lipidic, necrotic, or calcified. Correlations among plaque characteristics and the slow flow phenomenon were analyzed.
Results: Slow flow during PCI was observed in 11 patients (11.6%). Both the absolute volume and percentage of necrotic plaque were significantly higher in the slow flow group than the normal flow group (43.3 ± 33.5 mm^3 vs. 20.1 ± 17.2 mm^3, P=0.0004, 19.7 ± 5.1% vs. 14.6 ± 8.3%, P=0.047). Receiver-operating characteristic analysis showed that the necrotic plaque volume and necrotic plaque ratio were significantly better predictors of slow flow during PCI compared with total plaque volume. The cut-off value of necrotic plaque volume for predicting slow flow was 21.6 mm^3 (sensitivity of 81.8% and specificity of 61.9%).



Conclusions: Characterization of plaque by IVUS with iMap analysis can predict slow flow during PCI.

TCT-355

Frequency of Lipid-core Plaque in Culprit and Non-culprit Lesions by Intra-coronary Near-infrared Spectroscopy

Ryan D Madder, Mark C Pica, James A Goldstein, Simon R Dixon
William Beaumont Hospital, Royal Oak, MI

Background: Near-infrared spectroscopy (NIRS) is a novel intra-coronary imaging modality capable of identifying lipid-core plaque (LCP). We used NIRS to delineate the frequency of LCP in culprit and non-culprit sites in patients with acute coronary syndromes (ACS).
Methods: Consecutive ACS patients undergoing invasive coronary angiography (ICA) and culprit-vessel NIRS (InfraReDx, Burlington, MA) prior to percutaneous coronary intervention were analyzed. Target-vessel lesions >70% diameter stenosis by ICA were deemed culprit lesions. LCP was defined as a high probability signal within a 2 mm segment on the NIRS block chemogram. The frequency of LCP was determined in culprit and remote non-culprit sites (<70% diameter stenosis) in the target vessel.
Results: Among 46 ACS patients (age 61 ± 11, 74% male), all (100%) had ≥1 culprit lesion and 4 (9%) had multiple culprits. The majority of culprit lesions (62%) contained LCP by NIRS. In addition, remote non-culprit sites containing LCP were identified in 15 (33%) patients (Figure).

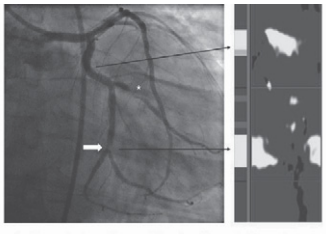


Figure. Angiography in a 49 year old male with unstable angina demonstrates culprit lesions in the mid-circumflex (white arrow) and first obtuse marginal arteries (asterisk). NIRS of the circumflex reveals LCP within the mid-circumflex culprit lesion and a remote LCP in the proximal circumflex (black arrows).

Conclusions: NIRS identifies LCP in the majority of ACS culprit lesions, a finding similar to that of autopsy studies. In approximately one-third of cases, LCP was present within the target vessel at a site remote from the culprit lesion. Whether these non-culprit LCPs represent future therapeutic targets requires further study.

TCT-356

Analysis Of Atherosclerotic Coronary Plaque Composition By Newly Developed High Frequency Tissue Characterization Of 40MHz Intravascular Ultrasound

Makoto Utsunomiya, Masato Nakamura
Toho University Ohashi Medical Center, Tokyo, Japan

Background: There are some methods to evaluate a characterization of the plaque by Intravascular Ultrasound (IVUS); however they have some limitations because their resolution is low. "iMap" is a device to assess the plaque composition by radiofrequency signals from a newly developed 40 MHz IVUS imaging system. Tissue characterization of iMap is performed by pattern recognition of excised human arteries. The end of this study is to assess the plaque component of acute coronary syndrome (ACS) by using "iMap".
Methods: Eighty-five consecutive patients and 97 plaques were volumetric analyzed by "iMap". In these, 34 plaques were culprit lesion of ACS, and 63 plaques were stable lesion. If necessary, IVUS was performed after thrombectomy with an aspiration catheter or pre dilatation with small size balloon.

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